Digital Beam Forming HW and Algorithm Library
(Simulation & Synthesis for FPGA)

Realizing modern phased array systems using Digital Beam forming requires thorough simulation & optimized FPGA implementation. The Digital Beamforming Library by UTS is a one stop solution by which user can perform starting from array configuration & planning to algorithm realization in target FPGA hardware.

The UTS Digital Beamforming FPGA library enables fast and efficient realization of Beamforming algorithms on FPGAs. The library is provided with multiple user settable options and allows realizing beam forming solutions for RADAR, SONAR and Telemetry/tracking applications. The array topologies covering linear, planar and circular planar are supported to cater for all popular array geometries. Algorithm library for other configurations such as conformal or irregular array arrangements are provided based on customer requirements. The supplied product consists below modules.

✓ FPGA compatible NGCs (VHDL Source code optional)
✓ MATLAB/OCTAVE simulation models
✓ Scripts to generate coefficient files based on the Beamforming requirements (compatible with embedded processors).

User can provide the required options through GUI. For embedded implementation all these options can be provided through scripts to generate the COEFF file and simulation models.

Key Features

✓ Option to perform Beamforming at element level or sub array level.
✓ Capable of generating simultaneous beams up to 32 (can be configured) for typical array geometry. Weight computation & update rate < 25 us.
✓ Options to control side-lobes level of each beam.
✓ Capable of modeling interference rejection by placing null towards them.
✓ Updating weight in real time is possible to support electronic switching & to perform fast sweeping search beams over given Azimuth & Elevation ranges.
✓ Mono pulse output can be directly generated.

Ordering Information

✓ UTS_DBF_R2.1S (Simulation Tool only)
✓ UTS_DBF_R2.1H2 (Zynq 7030)
✓ UTS_DBF_R2.1H3 (Zynq 7045)

Customized solution can be offered based on user requirements.
UTS Solution for Beamforming

Software

Beam Coefficients Computation and simulation

GUI

✓ element/sub array level radiation pattern configuration, spacing etc.,
✓ Array Geometry configuration
✓ Beam parameters settings like no of simultaneous beams to be formed in azimuth and elevation, null directions
✓ Configured array geometry and response viewing options.

Beam coefficients computation and real time beam beamforming

Real time Embedded software (VHDL&C)

✓ can be ported on processor platform (Zynq, ARM XX, Intel, power PC etc.,
✓ Functionally capable of all Features of GUI through API's
✓ Can be invoked in closed loop with RADAR DSP to give Adaptive beam generation capability
✓ coefficients computation at 25us rate in Zynq (contact UTS for detailed benchmarking results)

Hardware
(Refer UTS Application Note BFHW xx)

✓ 4-ch HW module for L,S,C and X bands
✓ Powered with Zynq FPGA real time beam forming firmware
✓ Resource optimized logic to cater for Beamforming over 1000's of elements and multiple beams in single FPGA
✓ Can be interfaced with Beamforming library GUI for ease of porting and verification.
✓ Synthesizable test bench to verify beam forming algorithm covering complete AZ and EL with 1 degree resolution

For initial algorithmic study and optimization

For final hardware porting and system realization

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